DIE CASTING ENGINEER

March, 1958

DIES AND DIE DESIGN

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- Solve Your Die Temperature Control Problems. Page 12.
- Prepaint Conditioning for Aluminum Die Castings. Page 14.
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- Some Notes on Die Design. Page 20.

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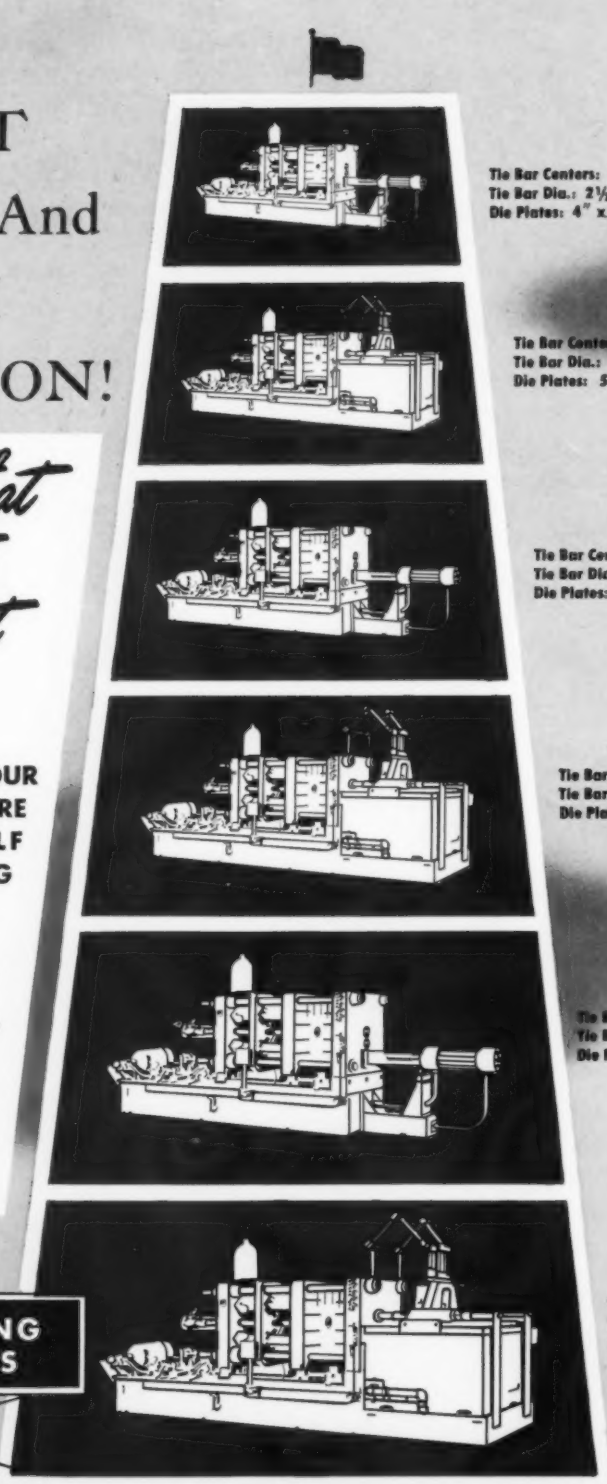

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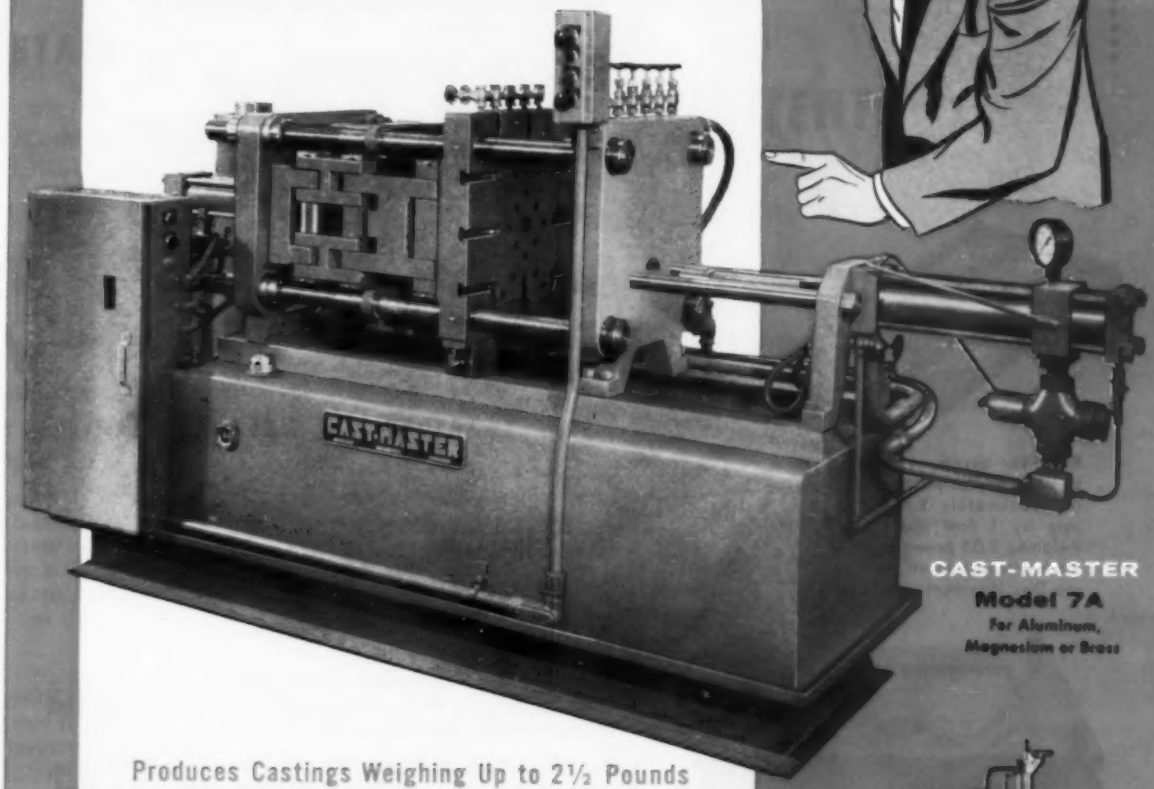

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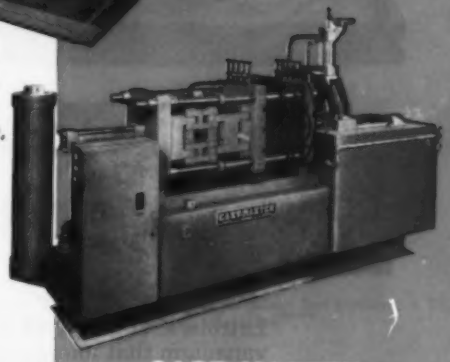

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The DIE CASTING ENGINEER is published quarterly by The Society of Die Casting Engineers, Inc.—a society for the improvement and dissemination of the knowledge of the arts and sciences of die casting, the finishing of metals, and the allied arts. The DIE CASTING ENGINEER offers a concentrated coverage of management and engineering in the die casting and directly related industries.

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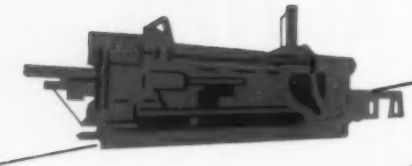

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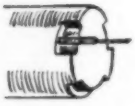

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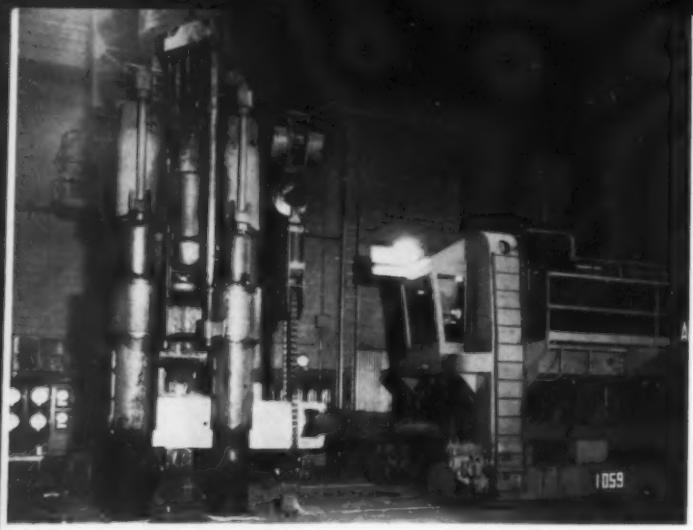


COVER STORY

FIGURE 1

FIGURE 2

Pressure casting apparently came into being about 1850; from that date die material has been one of the most important economical factors in the die casting process and will remain so in the future. With improved resistance to temperature in the die steels used for molds, we have all seen the evolution from lead to zinc to aluminum die castings. Further improvement would mean a much greater use of brass and copper die castings; we all dream of the day when suitable dies will make steel casting a possibility. Die casting dies are generally very expensive and a goodly number of finished parts are necessary from a set of dies to make the process economically feasible.

High Temperature Tooling for Die Casting

E. E. HALL, *Manager, Technical Service, Universal-Cyclops Steel Corporation*

TODAY THERE ARE MANY TYPES of hot work tool steels for such applications as forging dies, mandrels, extrusion and die casting dies, and swaging tools. These generally fall in three categories of chemical composition: the chromium type, the chromium-tungsten hot work group and the tungsten hot work steels. The first of these, with 5% chromium as the principal alloying addition, is most widely used for die casting applications. Several of these were developed especially for the economical and efficient molding of non-ferrous metals in the molten state. AISI Type H13 is the most popular steel for dies for the pressure and static die casting of low melting temperature zinc, magnesium, aluminum and aluminum bronze. Dies for copper and brass, which are molded in the plastic state, are largely confined to AISI Types H21 and H22, both steels of the tungsten hot work group, with greater resistance to temperature. The higher temperatures required to form copper alloys, however, cause early deterioration of the dies, making many parts impractical in these metals. More heat-resistant dies are necessary to correct this. Considerable work is being carried on in an effort to develop suitable die materials to solve these problems.

Metallurgical characteristics required for die steels and dies are very complex. In the annealed condition, steels should have uniformly sound structures and exhibit good machinability. Minimum movement should occur during heat treatment. Heat treated dies should have high resistance to heat checking, sufficient toughness to resist work stresses, sufficient hardness to resist deformation in service, adequate wear resistance to assure good life, good thermal conductivity, resistance to softening in service and resistance to erosion and washing. Unfortunately, any adjustments in chemistry or heat treatment to improve any one of the above factors usually means that some of the other characteristics are adversely affected and, hence, all present day materials are a compromise aimed at the optimum combination of properties to accomplish specific jobs.

A brief discussion of the above factors to clarify the effects of steel processing, chemistry and heat treatment, are in order. Uniformly sound structures are accomplished only with extensive steel melting and processing knowledge. Good structures have been available in small sized dies for many years but with the demand for larger and larger dies, processing techniques have become increasingly important: it has been a constant struggle to produce sound structures in the larger die sizes desired. A very careful balancing of ingot mold design, melting techniques, pouring and hot topping practices and ingot cooling, are necessary to produce sound ingots in the 20,000 to 25,000 pound weight class. Until recently processing equipment was not available to handle such ingots even though made under the best of conditions. Universal-Cyclops pioneered in the installation of fast acting presses capable of hot working such ingots sufficiently and properly to maintain structurally sound and uniform conditions throughout the cross section of these large sizes. Figure 1 shows the 2,000 ton press at our Titusville, Pennsylvania, plant working a 22,000 pound ingot of our Thermold AV (AISI Type H13) die casting die steel. Die blocks weighing up to 10,000 pounds are now a reality. This equipment is the biggest single stride in many years toward accomplishing sound and uniform steel for large blocks. Figure 2 shows a macroetched disc from the center of a block measuring 18" x 35" x 48" and weighing 8,500 pounds. It will be noted that sound, homogeneous conditions exist throughout as a result of the ability of heavy presses to penetrate to the center of large sections.

Machinability generally decreases as alloy content increases. The benefits of higher alloy content outweigh the machinability problems and it is necessary for the die manufacturer to learn to deal with this problem; low annealed hardnesses and uniform structures are a great aid in the machining of any die steel.

Minimum movement in heat treatment is extremely important to prevent the necessity of excessive finishing after heat treatment and before the dies can be put to work. Fortunately, the 5% chromium steels with their air hardening characteristics, are optimum from this standpoint and with proper handling very little movement occurs.

The greatest single factor in die failures after heat treatment is heat checking. Heat checking results from the continuous cycle of expansion and contraction, plus oxidation, that occurs while the die is in use. Hotter and faster cycles

Recommended for:	Types
Zinc	A, B, L2, H13
Magnesium	H13, H14
Aluminum	H13, H14
Brass	H21, H22, H23

AISI	COMPOSITION							HEAT TREATMENT (°F)				Brinell
TYPE	C	Mn	Si	Cr	W	Mo	V	Preheat	Hiheat	Quench	Temper	Hardness
A*	.40	.40	.25					Used in Annealed Condition				
B*	.40	.75	.25	1.00				1200	1575	Oil	1300	225
L2	.50	.75	.25	1.00			.15	1200	1550	Oil	1300	225
H13	.35	.45	1.00	5.00		1.40	1.00	1500	1825	Air	1100	425/475
H14	.40	.45	1.00	5.00	5.25	.30		1500	1900	Air	1150	425/475
H21	.35	.25	.35	3.25	9.50		.50	1500	2150	(1)	1200	425
H22	.35	.25	.35	3.00	11.00		.40	1500	2150	(1)	1225	425
H23	.35	.35	.50	12.00	12.00		1.00	1500	2300	(1)	1200	425

* No AISI Designation

(1) Air, Oil or Salt

Dies should be hardened in atmosphere-controlled furnace, a salt bath or by packing in spent pitch coke or used cast iron chips. Surface protection during hardening is very important to keep oxidation and decarburization at a minimum. Care should also be exercised to avoid carburization.

To minimize distortion, dies should be heated very slowly from a low temperature and brought gradually to the high heat temperature.

Many die casters gas nitride steel H13 prior to putting in service. A temperature of 975°F is recommended. Such nitrided dies give improved life and the high surface hardness resists peening.

FIGURE 3 **HOT WORK STEELS FOR DIE CASTING DIES**

AISI	COMPOSITION						HEAT TREATMENT (°F)				Brinell
TYPE	C	Mn	Si	Cr	Mo	V	Preheat	Hiheat	Quench	Temper	Hardness
H11	.35	.45	1.00	5.00	1.40	.40	1500	1825	Air	1000	425/475
H13	.35	.45	1.00	5.00	1.40	1.00	1500	1825	Air	1100	425/475
440C	1.00	.45	.50	17.50	.50		1500	1900	Oil	1100	500

H11, H13 recommended for cores

440C recommended for ejector pins

These steels frequently nitrided for these applications.

FIGURE 4 **HOT WORK STEELS FOR CORES AND EJECTOR PINS**

cause cavity surface temperatures to closely approach the temperature of the metal being cast and, hence, earlier failures. Heat checking is controlled by carbon and alloy content and is influenced by hardness. Susceptibility to heat checking increases with increasing carbon contents. Carbon in the range of .35-.40% has been found best considering other factors involved. Susceptibility to heat checking decreases with increasing alloy content. The tungsten hot work steels would seem to be best from this standpoint but they are less tough, are more hazardous during the cooling cycle and require higher hardening temperatures than the chromium steels. Each type of hot work tool steel has an optimum hardness range; hardnesses either above or below this optimum will cause heat checking prematurely. Present steels are adequate for the forming of zinc, magnesium and aluminum since heat checking does not occur until after an economical number of parts has been produced. This is not so with copper alloys or other materials requiring higher casting temperatures.

Toughness is obtained by the use of low carbon contents. Since, however, hardness and wear resistance are improved with higher carbon contents, it is necessary to compromise with this element. Usually about .50% is maximum for low alloy types while the more highly alloyed grades contain carbon as low as .25%. Chromium and nickel additions usually tend to increase toughness but toughness usually decreases with increasing amounts of other alloying elements.

The ability to heat treat die steels to high hardnesses is almost entirely dependent upon carbon content, increasing amounts of carbon reflecting in higher hardnesses. Best die life is usually accomplished when the Brinell hardness is in excess of 375. However, acceptable life is obtained with lower hardnesses where zinc is being cast.

Wear resistance is a function of carbon and alloy content separately or in combination and is influenced by hardness. The higher the carbon and/or alloy content and/or hardness, the more wear resistance.

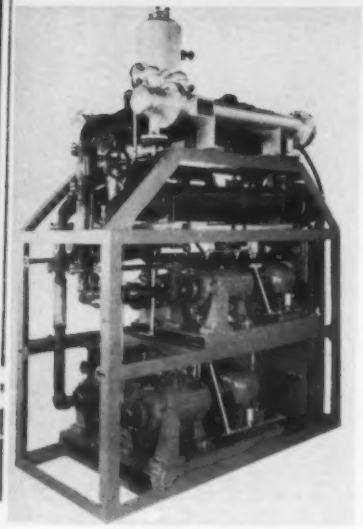
Good thermal conductivity is evident in most of the present-day die steels. This characteristic reflects itself in the ability of the die material to quickly carry away heat from the surfaces of the die coming in contact with the hot metal, thus cutting down the extremes of temperature gradients and retarding heat checking.

Resistance to softening in service is secured by the addition of alloys such as chromium, tungsten, vanadium and molybdenum. As total alloy content increases there is a corresponding general increase in the optimum hardening and tempering temperatures. The greater the ability of the material to resist softening by tempering, the greater the ability to retain hardness at working temperatures after complete heat treatment. *(Concluded on Page 22)*

FIGURE 5 **STEELS FOR TRIM DIES**

AISI	COMPOSITION							HEAT TREATMENT (°F)				Brinell
TYPE	C	Mn	Si	Cr	W	Mo	V	Preheat	Hiheat	Quench	Temper	Hardness
W1	1.00	.25	.25					None	1450	Water	450	60
O1	.90	1.20	.25	.50	.50		.25	1200	1475	Oil	450	60
A2	1.00	.65	.25	5.25		1.10	.25	1450	1775	Air	950	59
D3	1.50	.30	.25	12.00		.80	.90	1450	1800	Air	950	59
M3	1.00	.25	.25	4.00	6.25	6.25	2.40	1550	2200	(1)	1050	64

(1) Air, oil or salt. M3 should be triple tempered



Three zone operating unit

This is a new aproach to one of the problems in the die casting of metals. It utilizes the basic principles of heat transfer in the control of die temperatures. The problem is analyzed from this viewpoint, the applicable principles of heat transfer outlined, and the factors involved in the accomplishment of control clarified. Thermolator* Control is a high velocity circulation of a heat transfer liquid whose temperature is accurately controlled. Its success is dependent on the engineering designed into the die.

* Registered Trademark. Manufactured under U.S. Patent No. 2623088

Three zone control unit

Here is one way to . . .

Solve Your Die Temperature Control Problems

H. A. MEYRICK, *President, The Industrial Mfg. Corp.*

FUNDAMENTALLY, THE PROCESS OF die casting consists of *adding* heat to a metal in order to change its phase from solid to liquid, *injecting* the liquid metal under pressure into a die, and *removing* that heat from the metal to convert it back into a solid having the desired shape. This process is repeated under a uniform time cycle, and any variation in either of the three basic factors, pressure, time, and heat will affect one or both of the other two. A graphic picture of this process showing the relationship between time and heat is shown in Figure 1.

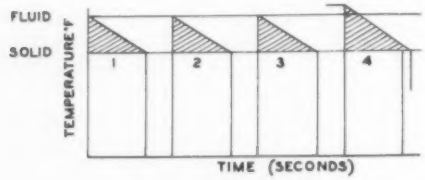


FIGURE 1

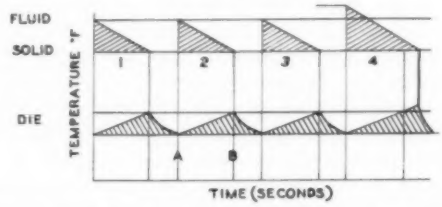
This time-temperature graph shows four cycles, the first of which are under uniform conditions of all the process variables. The fourth cycle shows the effect on time caused by raising the temperature of the fluid metal.

The die, of necessity, must be capable of withstanding the high pressures involved, and this mass of metal will pull the heat out of the fluid casting even if no provision is made in the die to control it. Under these conditions the flow of heat will follow the path of least resistance and will not be necessarily uniform. In a multiple cavity die, for example, one of the castings might be ready to come out of the die in a shorter period of time than another, but the timer controlling the opening of the die is set to accommodate the slowest. In another die, where one part of the surface is at a different temperature than another, the casting may not have a uniform surface finish or internal structure.

There is a die temperature, which in combination with the other process variables, will produce the optimum results, both in time and uniform castings. In general, the lower the die temperature, the faster the heat will be removed, but frequently it may be necessary to increase the fluid temperature and/or pressure to ensure filling the die. This may neutralize the "advantage" and even result in a longer cycle.

The thermal load, sensible heat of cooling and latent heat of fusion, is intermittent, causes the die temperature to fluctuate during each cycle. This is illustrated in Figure 2. This

FIGURE 2



graph shows four cycles, the first of which are under uniform conditions. The fourth illustrates the effect of an increase in fluid temperature. It is the average temperature of the die which establishes the rate at which the heat is removed. To maintain the average temperature at the lowest possible point it is necessary to reduce the amount of temperature rise. The die temperature at *A* must be held constant since it is the optimum temperature which produces the surface finish of the casting. The time cycle is established from this point.

The temperature of the metal at the *Solid* point, Figures 1 and 2, is a constant for each metal or alloy being cast. The temperature of the metal at the *Fluid* point should be just high enough to insure filling the die and produce castings with the desired characteristics. When the temperature is higher there is additional heat which must be removed, and the time cycle is correspondingly lengthened. Maintenance of the average die temperature at the desired level not only permits faster cycles but also influences the quality of the casting by establishing uniformity of internal molecular formation. Since time is a factor in both, the following graph, Figure 3, illustrates how variation in average die temperatures affects the time cycle.

Figure 3-a illustrates the effect on the time cycle when the average die temperature is only slightly above the starting temperature. This die is adequately channeled so that the heat transfer to the circulating liquid is excellent. Figure 3-b illustrates the effect on time when the channeling is such that the heat transfer is only fair, resulting in a higher average die temperature. Figure 3-c illustrates the effect

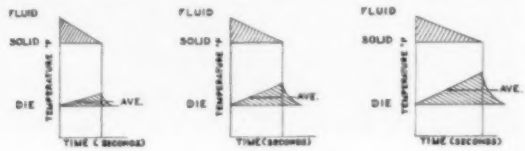


FIGURE 3

when the heat transfer is poor, and the average die temperature is even higher. All three cases have channeling sufficient to enable the die temperature to recover to the same starting temperature.

The molecular formation of the metal which produces the surface finish of the casting is established by the die temperature in combination with the other process variables. This factor is independent of the time required to remove the heat from the metal. An operation in which quality of surface finish is used as the index of efficiency may be erroneous.

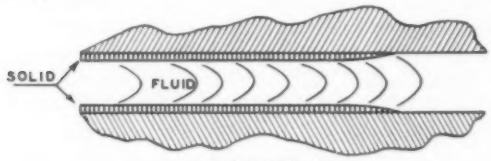


FIGURE 4

The flow of metal in filling the die and the formation of the surface finish might be illustrated in the magnified cross-section of a die, Figure 4. There is a thin skin of solid metal formed on contact with the die surfaces and the fluid metal flows between these two skins until the fill is complete. The thickness of these skins is a function of the thermal differential between the die temperature and the metal temperature. A low die temperature may result in surface defects such as weld lines, crazing, scaling, etc. Too high a die temperature may result in sinks, blisters, etc. The optimum molecular structure between the skins is established by the right combination of all the process controls, and even small deviations may result in defective castings or slower cycles or both.

The removal of sensible and latent heat from the fluid metal to convert it to a solid, in the die casting process, must be considered as two separate and independent problems. The first is one of obtaining uniformity of temperature over the die surface at the start of each cycle. The second is the problem of handling the heat load to result in the lowest possible average die temperature. It is conceivable to have one without the other.

A controlled die cooling system employs the principle of high velocity circulation of a controlled temperature liquid. This liquid should have good thermal characteristics, operate at low pressure, and have as many other desirable features as possible. The chemical industry produces several good heat transfer liquids, and there are pumps and other equipment which are successfully handling these liquids for heat transfer in many industrial applications.

TABLE I

Thermolator control of die temperatures employs five basic factors: the first two are a function of the controller, and the last three are functions of the die.

1. **Accurately controlled liquid temperature.**
2. **High velocity circulation.**
3. **Liquid must contact the metal whose temperature is to be controlled.**
4. **Contract area - maximum.**
5. **Hydraulic resistance - minimum.**

The face of a four cavity die with the sprue and runner system omitted is shown in Figure 5. The temperature of the

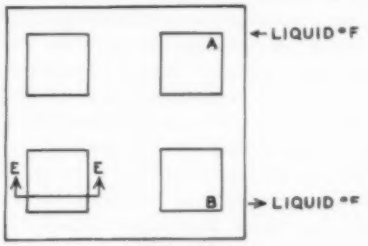


FIGURE 5

die surface at *A* will be established by the temperature of the liquid underneath that point. When the temperature of the liquid is held constant the die temperature at *A* will tend to remain constant. To have the same temperature at *B* the liquid under *B* must be the same as it is under *A*. Since there must be a temperature change in the circulating liquid to accomplish heat transfer, this change can be held to a practical minimum by high velocity circulation. These results are a function of factors 1, 2, and 5, Table I.

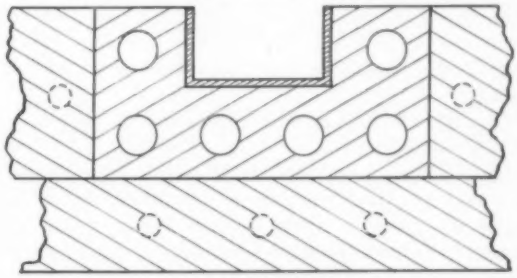


FIGURE 6

Section E-E, enlarged in Figure 6, illustrates the application of other factors. The channeling shown by the dotted lines violates item 3 in Table I in that the liquid is not in contact with the metal whose temperature is to be controlled. The interface between the metal parts of the die offers resistance to thermal flow, resulting in a rise in the surface temperature during the cycle, Figure 3-c. The channeling shown by solid lines, indicates the desirable type of construction and meets the requirements of 3 and 4, Table I. In addition, the size of the channeling should be large enough in diameter to insure minimum hydraulic resistance, 5, Table I, and permit high velocity circulation.

Thermolator Control of die temperatures is a technical approach to one of the variables in the die casting process. Compromises will have to be made since it will not be possible to obtain ideal conditions in all dies. The key rests with the die designer. If his viewpoint is based upon the principles in Table I, and he lays out the channeling *first* rather than last, the results will justify the adoption of a control system.

■ ■ ■

PREPAINT CONDITIONING for ALUMINUM DIE CASTINGS

JOHN C. RUTTLE
Technical Service Representative
Oakite Products, Inc.

WHERE LONG LIFE IS REQUIRED of the painted coating on aluminum die castings, two things are essential: (1) thorough cleaning, and (2) a prepaint treatment designed to condition the surface for better paint receptivity and longer paint adhesion.

Proper pre-paint treatment of aluminum renders the surface inert, preventing the formation of gas and corrosion products, and eliminating any deteriorating reaction between the aluminum and oil in the paint, and between the aluminum and any moisture which might creep under the paint.

There are several methods of treating aluminum for painting. Heavier sections destined for rugged use may be sandblasted or wire brushed, but such treatment is not recommended for lighter gage metals because of the danger of warping. Other methods, using chemical or electrolytic treatments, have been developed; several of them have been patented and are available in proprietary compounds.

The solvent-phosphoric acid compounds are particularly useful soils and oxides—at the same time they prepare the metal for painting.

One such material, for instance, has solvent and detergent properties that remove stamping and forming oils, rust preventives, carbon smuts, soldering and welding fluxes, identification inks, and similar soils. Its acid ingredients, combined with special accelerating agents, quickly remove tarnish, heat scale, and other oxides. At the same time, the solution microscopically etches aluminum castings and develops a surface condition that is favorable to the adhesion of paint.

Particularly effective in tank application, this compound is usually diluted with water from 10 to 25% by volume. Heating the solution to about 140°F will increase its detergent action. Cleaning is followed by rinsing and drying. Some of the products which are now being treated with this material are auto parts, fuel oil burner parts, humidifier parts, plaques, refrigerator parts, toys, and laundry machine parts. In many cases, the use of this solution has eliminated separate deoxidizing and paint conditioning operations, together with the rinses which usually accompany them.

Where oxides present more, and greasy soils less, of a problem, an acid-detergent compound may be recommended. Such a material, used with water in a range of 5 to 50% by volume, removes light soils quickly and thoroughly, etches and prepares the metal for paint, increases resistance to corrosion, and localizes corrosion if the painted surface should be broken.

In some cases, it may be desirable to clean and phosphate condition aluminum in a pressure spray washing machine. Compounds designed for such application are available. After washing for 1 to 3 minutes in the machine, parts are then rinsed and given a final hot rinse, acidified to prevent staining and to seal the conditioning film.

Where resistance to abrasion is not a primary consideration, chromate treatments are probably the most effective prepaint conditioners.

While detailed application procedures may vary somewhat with the different proprietary conversion coatings as recommended in the individual manufacturer's instructions, the following may be considered as typical:

Photo courtesy Peerless Pressed Metal Co.

Conversion coating stage in a tank operation. Alkaline cleaning and etching and running rinse precede the immersion in the conversion coating. Another rinse follows. Note use of aluminum basket for parts to prevent electro-chemical reaction between tank and parts being processed.

Where parts are processed through tanks, they are first cleaned in an inhibited alkaline solution, made up at about 6 ounces per gallon of water, at 160° to 170°F for about 5 to 10 minutes. Where an etched surface is desired, a non-inhibited alkaline solution is recommended. Parts are immersed into the solution, made up at 3 to 4 ounces per gallon, at 160 to 170°F until the desired etch is obtained.

Parts are then given a cold running rinse, and immersed in an acid deoxidizing bath to remove the oxides and smut which may have been formed in the alkaline cleaning solution. Deoxodizing solution is made up at 10 ounces per gallon of water, at room temperature. Immersion is for 1 minute. This stage is again followed by a cold running rinse, in a tank different from that used after the alkaline cleaning bath.

Parts are then immersed in the conversion coating solution, made up at 3 ounces to the gallon of water, at temperatures between 70 and 100°F, for a period of three minutes. A third cold running rinse follows, then dry down with air.

In tank applications, it is important that the parts proceed as rapidly as possible from the alkaline cleaning bath to the rinse, to avoid drying down of the alkaline solution on the aluminum.

No special equipment is required in the alkaline cleaning stage. For the deoxidizing bath, a stainless steel tank, or one lined with lead or vinyl chloride-type plastic, is recommended. Stainless steel, polyethylene, or Koroseal-lined steel tank is recommended for the conversion coating stage.

Where parts are processed through spray washing machines, the first stage consists of washing with a non-foaming, non-etching alkaline detergent, at concentrations of from ½ to 1 ounce per gallon of water, temperature 160°F for 1 to 2 minutes. The second stage is a cold spray rinse. The third stage consists of the conversion coating, at 2 ounces per gallon of water, temperature from 80 to 100°F, for 1 to 2 minutes. A cold spray rinse is the fourth stage, and is followed by drying.

It is important to note that during alkaline or acidic treatment, aluminum in contact with steel, copper, or heavy metal will be subject to electro-chemical attack. Racks, hooks, and baskets used to process aluminum parts should be made of aluminum, and parts should not touch the steel tank or heating coils during processing. ■ ■ ■

A brief look at *all* the types of . . .

VACUUM DIE CASTING EQUIPMENT

MEYER R. TENENBAUM, *Lester-Phoenix, Inc.*

THE APPLICATION OF VACUUM to die casting goes back a number of decades, as long ago as 1920, when early workers sought to exploit the exciting possibilities of this device. It is a fact, and the record shows, that counter wheels have been die cast in or by vacuum since early 1922. Since that time a number of serious workers have attempted, with varying degrees of success, to apply vacuum principles to modern die casting techniques and processes, and there are in operation today a rather sizeable group of people using this device in one way or another.

We might briefly summarize the work which has been done to date by describing the various means by which vacuum has been applied to die casting. To begin with, I am choosing to ignore the difference between alloys in this discussion since each of the methods to be described can be somehow applied to both hot chamber and cold chamber die casting, thereby covering the alloys of lead, tin, and zinc, as well as aluminum and magnesium.

One basic approach to the use of vacuum, and one still in use for special small die castings, is the enclosure of the entire die casting machine in a suitable cover or hood to serve as a "Bell Jar" in which to die cast with complete unconcern for differences in pressure in the system, and which requires no special timing devices. This system may be applied to small machines of limited capacity where the shot sizes allow reasonable runs without the necessity for unbuttoning the hood at too frequent intervals. Such parts as lead or zinc gears, counter wheels, small parts used in corrosive atmospheres, and others are being cast in this manner.

The limitations of this method are obvious, since the operation must usually be fully automatic, and of very small size. It has certain inherent advantages, though, such as freedom from pressure differences, high vacuum level, and a bonus, to some degree, of "degassing" the metal in the pot prior to die casting.

Quite recently a system was worked out in which the enclosure was somewhat smaller that the earliest type, being limited to the die space of the machine, i.e., the space between the movable and stationary platens of the die casting machine. It does, however, encompass the bars of the machine and therefore houses a considerable volume around the machine in this vicinity. The enclosure (hood) must be designed to close and seal ahead of the die faces, and remain sealed when the die faces close. It is therefore a rather critical assembly since it must either be made adjustable, a rather difficult sealing task, or it must be replaced when a new die of different height (thickness) is used. It must be further redesigned or altered should the die have slides or core pulls which interfere with the dimensions of the hood. Obviously each such change not only increases the difficulty of sealing but also increases the volume around the die and thereby increases the load on the vacuum system.

In use, the sealing faces of the hood are brought together, the vacuum drawn, and the die faces then locked. The casting is now made and withdrawn in the usual manner. It is observed that there is some interference with the operator in reaching into the hood for his casting, and in cleaning and lubricating the die. This system, when sized reasonably in terms of pump, accumulator, and motor will operate at 15-20 inches of mercury, although some few users have claimed as high as 22 inches of mercury. It is seen in use primarily on zinc today.

We come now to a group of vacuum systems, all of which have certain similarities, each of which having their own particular merit. Some, of course, are more highly developed at the moment than the others, but each attempts to achieve the same results.

The first of these systems was designed by an eastern die caster, and involves simply sealing the die faces and the ejector box. The vacuum is drawn through the ejector box by means of two or more holes running through the ejector die to a vacuum overflow or accumulator. This is merely a groove such as can be made by a ¾" ball cutter about ½" deep and circling most of the cavity area. It is separated from the cavity itself by a number of vents some 0.006" deep. Vacuum may be drawn through the cover half from this accumulator by cross-drilling; an even simpler approach. The vacuum is drawn after the plunger (or piston) has passed the pouring hole (the inlets, if zinc), and but for a delay of under one second the shot is completed in the normal fashion. It is important to note that the vacuum is on during the entire filling time. This system is applicable to either aluminum or zinc (cold chamber or hot chamber) and has the advantage of low initial cost, low conversion cost, and operates in the range of 26-30 inches of mercury. It is readily adaptable to a central system, and its proponent has a system for seven machines in operation.

A second and quite similar system, independently designed by a western die caster, draws vacuum at the parting line—past a valve and through a groove directly to the cavity. In this system the metal is poured and vacuum drawn the instant the plunger starts forward. A switch cuts in the shut-off valve just before liquid metal reaches it. It operates in the range of 26-28 inches of mercury. Several other systems of great similarity to this exist and differ only in timing or in the method or location of valving.

In all systems which employ no hood arrangement a few facts should be noted. They do not in any way (broadly speaking) encumber the die or limit the die caster. They usually do not limit die size or die height. The operator is almost unaware of vacuum equipment existing on his die. Some of these, further, have the advantage of keeping the vacuum on for the entire filling cycle, thereby removing the gases or vapors produced when hot metal hits the lubricated die faces, a most serious problem.

The writer wishes to debunk two often-heard ideas. It takes just as much pressure to make a good die casting with vacuum as it does without, and, it takes just as large a machine to do the job with or without vacuum. These statements represent the facts. Merely calculate the clamping force of two 40" x 40" platens held together by 14.7 psi and see what help you derive from vacuum in this respect. Remember, if the die blows you either lose vacuum or pressure or both.

Editor's note:

WE EARNESTLY invite your comments on the subject of vacuum die casting. Mr. Tenenbaum is preparing articles pertinent to the day on this and other subjects for future issues of the DIE CASTING ENGINEER.

REFEREE METHOD OF TEST FOR CLAMPING CAPACITY

First Proposed Machine Standard

MACHINE STANDARDS and their establishment are being considered by The Society of Die Casting Engineers through its National Standards Committee in cooperation with the manufacturers of die casting machines. Clamping capacity of a die casting machine, one of the most important of machine standards, was the first to be undertaken by the committee. An excellent method for establishing clamping capacity beyond all doubt has been devised, tested and approved in several industries similar to Die Casting. This same method is now being proposed by the Society of Die Casting Engineers for the whole Industry.

SDCE MACHINE PERFORMANCE STANDARDS

I. Clamping Capacity

A. Scope - This method of test covers the procedure for determining the maximum clamping load developed by die casting machines with either a mechanical toggle clamp, a full hydraulic oil cylinder clamp, or any combination of these up to 2000 Tons, inclusive.

B. Apparatus - The apparatus for testing a given machine shall consist of the following:

1. One 33018A type MB portable strain indicator, or approved equal.
2. One package of type A-3 or A-5-1, SR-4 strain gages of 120 ohms nominal resistance or approved equal.
3. One 33150 Duco Cement Kit, or approved equal.

(All of the above may be ordered from Baldwin-Lima-Hamilton Corporation, Testing Equipment Department, Philadelphia 42, Pennsylvania, or an approved equal source.)

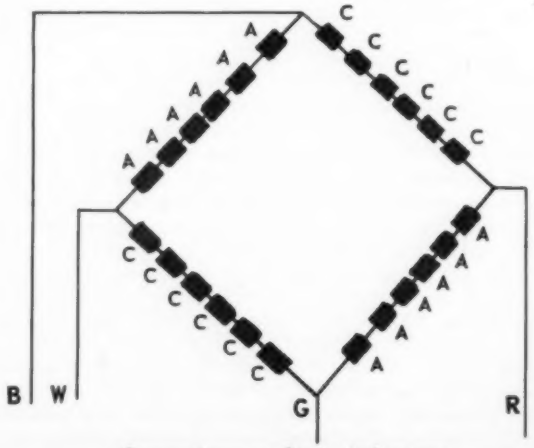
4. 75 feet of Number 20 plastic insulated copper wire.
5. One type 430 Helicoid Test Gage, or approved equal. Range O - 3000 psi. or O - 6000 psi., 8½" white dial; one-fourth of one per cent accuracy; flangeless type, bottom connected, stem mounted, ¼" pipe thread, metal case.
6. One cylindrical hollow steel test ring, with parallel end surfaces and with dimensions as indicated hereinafter; **(Tentative.)**
   a. For machines with ratings from **35** to **150** Tons; 8" OD x 5" ID x any length convenient for the machine, between 8" and 10".
   b. For machines with ratings from **75** to **350** Tons; 13" OD x 10" ID x any length convenient for the machine, between 8" and 10".
   c. For machines with ratings from **200** to **500** Tons; 18" OD x 14½" ID x any length convenient for the machine, between 12" and 15".
   d. For machines with ratings from **350** to **1000** Tons; 28" OD x 24" ID x any length convenient for the machine, between 20" and 25".
   e. For machines with ratings from **1000** to **2000** Tons; 39¾" OD x 34¾" ID x any length convenient for the machine, approximately 50".

   A suitable eyebolt hole for lifting in the approximate center of the ring, lengthwise, and a ½" clearance hole near one end for bringing out the lead wires from the strain gages are permissible.

C. Preparation - The SR-4 strain gages, 24 in number, are cemented in pairs on the inside surface of the ring at intervals of 30° around the circumference at the approximate center of the ring lengthwise. In each of twelve pairs of gages, one gage is mounted so as to measure strain along the axial direction, the other gages are mounted at right angles to the first so as to measure circumferential strain. Each pair of gages thus forms a T-shaped configuration. The gages are wired in series so as to form a 4-leg full Wheatstone bridge circuit; two legs containing six axial gages each, the other two legs containing six circumferential gages each. The complete circuit is wired by alternating axial and circumferential legs. See diagram, *Wiring Diagram of Circuit.*

WIRING DIAGRAM OF CIRCUIT

A = Axial C = Circumferential



------ Connections on Strain Indicators ------

D. Calibration

1. With the gages securely mounted and checked for short circuits, the testing ring is calibrated on a Universal Testing Machine of the type generally available at any engineering college and periodically checked for accuracy in accordance with ASTM Standard E4-50T. With the ring in place, the testing machine slowly loads and unloads the ring several times to insure proper seating and unloading with the readings of the strain gages noted on the strain indicator. When the unloaded ring consistently returns to a zero reading, the test loading begins with strain being recorded on the indicator, through the entire die casting machine range or testing machine range, whichever is lower.
2. Where the machine to be checked has a greater clamping tonnage than the testing machine available, the partial calibration from the testing machine will be acceptable as if the entire range had been calibrated; if the response of the ring is linear throughout the calibrated range, and provided the calibrated range is not less than 40% of the total range over which the ring will be used.
3. This will determine the calibration constant, K, of the ring, which is defined by the equation: Load in tons = K x strain indicator reading in micro-inches/inch. The calibration constant is to be determined with the gage factor setting of the strain indicator at 2.00. All subsequent tests shall be run with the same gage factor setting. The calibration constant, K, as determined by test shall be checked against the following formula and shall conform within 5%.

$$K = \frac{0.012 \times A}{G.F.}$$

where:

A = Cross-sectional area of ring in square inches.

G.F. = Gage factor A-3 or A-5-1, SR-4 gages used.

(Derivation of this equation is available on request.)

4. The date of this calibration shall be stamped on the ring and a written report from the testing agency shall be secured.
5. The test oil gage shall be calibrated against the master gage, or a dead weight tester, for accuracy. The date of calibration shall be marked on the gage and a written report from the testing agency shall be secured.

E. Procedure

1. The test ring, thus calibrated and marked with the date of calibration, should be mounted in the centerline of the machine to be tested and, if necessary, supported in this position with wooden boards and blocks. During the test the calibrated oil pressure gage should read the maximum setting recommended by the machine manufacturer for the machine in question. The clamping tonnage of the machine should be tested at this pressure setting.
2. **Testing a hydraulic clamp** – The locking cylinder should be closed against the test ring and the full load of the hydraulic clamping cylinder should be exerted against the ring. The parallel ends of the test ring should be in full engagement with the surfaces of the two platens. At this setting of the clamp the deflection of the strain gages in the test ring is recorded on the Baldwin-Southwark SR-4 model MB strain indicator. This strain reading multiplied by the calibration factor for the test ring gives the actual effective force of the clamping cylinder and for the purpose of this test can be recorded as the maximum clamping tonnage of the machine being tested.
3. **Testing a mechanical clamp** – This test is identical to the test for the hydraulic clamping machine except that the maximum clamping tonnage is recorded at the point of toggle adjustment just before the machine clamp will stall. In other words, the toggle clamp of the machine is adjusted as tightly as possible without causing the toggles to stall short of going home to full lock position. At this setting, the maximum clamping tonnage of the machine should be recorded.
4. Three machines of a given model shall be tested by the above procedure to establish rated clamping capacity. The rated clamping capacity shall be considered established, provided none of the three test readings shall fall below the assigned capacity by more than 2½%.
5. The above procedures shall be established as the SDCE "Referee Method" in case of dispute or of challenge. If called on to do so, the manufacturer shall be prepared to demonstrate his published clamping capacity by the above method.
6. **Alternate methods:** In lieu of the SDCE "Referee Method," manufacturers may use alternative tests for their own purposes as long as they can demonstrate their published clamping capacity by the "Referee Method" if called upon to do so.

F. Certification – The calibration of the test ring, the calibration of the oil pressure gage and the clamping pressure tests should be carried out by each manufacturer. A report should be maintained including the date of calibration of the test ring, as well as the date of calibration of the calibrated oil pressure gage.

G. Publication

1. When a manufacturer shall represent that he has carried out his locking tonnage tests in accordance with the test method herein described, he may be authorized to enter on any specification sheets the notation, "Determined by SDCE Clamping Capacity Test Method."
2. No specification sheets shall include this note until six (6) months after the test method is formally accepted by the present committee.

The National Standards Committee of the SDCE is working on a series of standards which, when approved, will be made available to the Society's members in a suitable form. The Machine Performance Standards are just one division of these standards for the Die Casting Industry.

We are vitally interested in your comments or suggestions regarding this and other standards. Please submit your ideas to us in written form.

■ ■ ■

Chapter News

SDCE NATIONAL OFFICERS

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DIRECTORS

Harris R. Shimel
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Herman J. Windolph

As the retiring president of the Society of Die Casting Engineers, I would like to welcome the new officers and offer to them my sincere best wishes.

Our Society, first conceived in the spring of 1954 by Mr. George Griffenham, has grown from the eleven man organizational meeting held in August of 1954 to a society of individuals extending from California to New York. Our society now has nine chapters, holding regular meetings, a publication of its own, *Die Casting Engineer*, and a standardization program.

Since ours is a society of individuals, the success of our society, its magazine and its programs are directly proportional to the efforts of the indviduals within the society.

Each member should bring in a new member to make our society grow. Our magazine needs technical articles, news items, question and answer columns and advertising. You as individual members are the best and most logical source for items for this publication—let it serve you.

HARRY E. ERIKSEN

This initial issue of the DIE CASTING ENGINEER for 1958 presents an opportune time for me to extend my personal greetings and welcome for the year, to the members, subscribers, advertisers and friends who make the SOCIETY and our publication possible.

I wish to pay special tribute to the members who make up the SOCIETY, to the advertisers whose support is necessary for us to publish the DIE CASTING ENGINEER, and to the directors and officers of the SOCIETY who serve unselfishly. I am counting on, and need, support of all to enable us to make 1958 the biggest year for the SOCIETY.

The challenge to serve as your president is great, but great is the future for die-casting. The SOCIETY is dedicated to that future. I look forward with pleasure to taking part in and helping direct the growth of both in 1958.

HARRY CAGIN

1 DETROIT and 2 SAGINAW VALLEY

The New Year was started off with two exceptional speakers and topics. On January 3rd, Mr. H. A. Meyrick, President of the Industrial Mfg. Corp., gave a timely report on "Thermolator Control of Die Casting Dies," in which he disclosed a functional and commercial method to more efficiently regulate heat transfer in a die. The February 4th meeting had an overflow attendance of 115 members and guests to hear Dr. George H. Found, V.P. and General Manager of Saginaw Bay Industries, speak on "The Importance of the Independent Die Caster to the Automotive Industry." The March 4th meeting of 142 heard a panel discussion entitled, "What's My Secret?" Bud Janke, Gil Taukert, Ollie Clayton, Lee Radke, and Ray Kells represented Die Design, Die Building, Die Building, Die Casting, and Metallurgy, respectively. Mike Tenenbaum moderated the panel. A big Stag Day Golf Outing is planned for June 28th at the Pontiac Country Club.

3 WESTERN MICHIGAN

January 14th found the chapter members and guests at Schnitzelbank Restaurant to hear William F. Fletcher of the Inland Container Corporation speak on "Methods of Packaging for Today's Markets." This was Inland's famous "Jug" speech, which centers around the tribulations of the packaging engineer who sets out to wrap up a jug for shipment. The jug package goes through many design phases until finally . . . but that's for Mr. Fletcher to reveal when he talks before your group. We substituted a March 7th "Ladies Night" Dinner and Dance for our usual February meeting. The big affair was held at the Green Ridge Country Club, and for those who attended it was a wonderful evening of dinner, dinner music, and dancing, all in a warm atmosphere. The next regular meeting was held on March 17th, when Raymond W. Naus and William J. Brinkman, Sales Manager and Vice President, respectively, of the Presco Casting and Manufacturing Co., spoke on "Permanent Mold and Die Casting." This was a joint meeting with the American Society for Metals.

4 TOLEDO

When Wesley Wight was transferred to Chevrolet operations in Detroit, it was necessary for us to hold another election of officers. The results are: Rolland S. Fulton, Jr., Chevrolet Passenger Transmission, GMC, Chairman; Ted E. Hansen, E. F. Houghton & Co., Vice Chairman; and Paul E. Phillips, Chevrolet Passenger Transmission, GMC, Secretary-Treasurer. Our January 14th meeting heard Ollie Clayton talk on "What Method of Die Sinking." He covered tool building and discussed design, building, and maintenance factors of die casting dies. Mr. David Sloane, Lester Engineering Vice President, spoke on "The Development of Solid Frame Die Casting Machines" and gave their advantages and disadvantages at our February meeting. The March 10th meeting enjoyed Foster C. Bennett's talk on "Magnesium Die Casting." Mr. Bennett is the Chief of Dow Chemical's metallurgical laboratory die casting section.

5 CHICAGO

On January 25th, V. L. Broczell, G. Hebel, E. L. Bauer, H. M. Straube, M. Shoka, R. O. Wunderlich, Syd LaVaine, Mr. Vorgany, W. Bodnaichal, and Ken Moulder of this chapter attended a live machine demonstration at the Onsrud Machine Works, Machine Tool Division in Niles, Illinois. Non-ferrous machining problems such as flash removal, face milling, contour milling, and profiling were discussed and observed. The group was treated to luncheon by Richard Nordby, Midwest Sales Representative for Ons-

rud's Niles Division, to complete the tour. The February 6th meeting heard Archie L. Spratt, Field Service Engineer for Vanadium Alloys Steel Co., speak on "Hot Work Steels for the Die Casting Industry." R. Scott Modjeska, nationally known for his research and direction of cleaning and plating, and now with Scientific Control Laboratories, discussed "Adding Sales Appeal to Aluminum Die Castings" at the March 6th meeting. The Golf Outing has been set for Tuesday, June 24th, at Glendale Country Club.

6 CLEVELAND

The West Side Turnverein was filled with members and guests of this chapter to hear David M. Morgenstern, President of the Nelmor Mfg. Corp., tell of "European Die Casting Techniques." Dave has very recently returned from a trip to Europe where he visited a number of die casting establishments. There is a great deal of interest in our Society on the part of the Zinc Alloy Die Casters Association (ZADCA). This London organization is connected with the European Pressure Die Casting Committee, which last year held its second International Pressure Die Casting Conference in Paris. Mr. R. Lewis Stubbs, Director of the Zinc Development Association, will be in the United States in April for meetings of the American Zinc Institute. The February 18th meeting heard Mr. B. L. Meredith, Research Metallurgist for the American Smelting and Refining Co., talk on "Factors Influencing the Quality of Die Castings." Charles W. Oshe, President of the New England Die Casting Company, enlightened our members and guests with his discussion of "A New System of Vacuum Die Casting," a very current topic.

7 NEW YORK

Our young chapter has had three very successful and well attended meetings with very able speakers and good fellowship. The November 21st meeting hosted Irwin Lubalin, General Manager of the Shaw Process Development Corporation, who gave an excellent talk and demonstration on the Shaw Process. This exceptional process is a cost cutting and time reducing method of making extremely close-tolerance castings without using expendable patterns. The January 22nd meeting of 75 members and guests featured John Atols, President of Atols Tool and Mold Corp., who spoke on "Die Design and Gating." This included a discussion on basic mold design and manufacturing. The February 19th meeting heard David Morgenstern speak on "An Evaluation of the Results Obtained at Nelmor on the Vacucast Process."

18 NEW ENGLAND

The Hickory House in Worcester, Mass. held 41 members and guests on January 23rd to hear John A. Atols, President of Atols Tool and Mold Corp., talk on "Die Casting, Die Design and Gating Problems." A lively discussion period followed his talk, "Die Casting in Europe and Vacuum Die Casting" was the talk given by Dave Morgenstern, President of Nelmor Mfg. Co., for our February 20th meeting at the Hickory House. Mr. Morgenstern elaborated on the development, growth, and requirements for a type of vacuum die casting. He went on to tell of die casting operations in France, Switzerland, Italy, and Israel. Further group discussion followed for the 46 present.

25 INDIANA

Fifty die casters and suppliers heard Mr. John Atols of Atols Tool and Die Corp., Chicago, talk on "Mold Design" at our February 6th meeting at the Casa Grande Restaurant in Kokomo. The campaign for additional members was launched at that meeting. The March 13th meeting of the chapter featured a tour of Guide Lamp Division, General Motors Corp., in Anderson, Indiana. Before the tour started, members and guests attending were guests of Guide Lamp at a dinner in the plant dining room.

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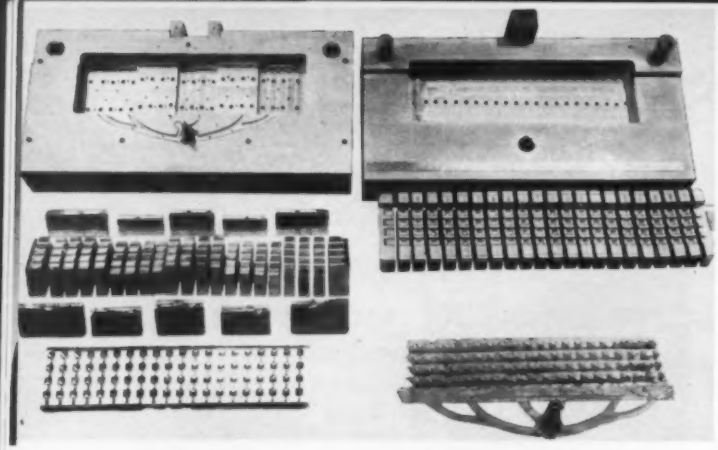

SOME NOTES ON DIE DESIGN

JERRY ALDERMAN
Sales Manager, Valor Tool and Machine Company

A BAD DIE DESIGN will eat up profits in two ways. First, the chosen die metals and die manufacturing methods may place an excessively large price tag on the finished die, whereas a broader view of all the materials and methods could well suggest the use of cheaper die metals and faster manufacturing methods. Second, in actual production the die may flash excessively, may produce a low percentage of usable castings, or may even crack and break. Now is the time to avoid such headaches by observing a few basic considerations.

Pick the Right Die Steel

When designing for zinc castings or other metals having melting temperatures less than 1000°F, the cavity steels should be pre-heat-treated to a hardness of 30 Rockwell^{C}. Aluminum die castings or other metals having melting temperatures above 1000°F usually require H-13 type steels which are heat-treated after machining to a hardness of approximately 50 Rockwell^{C}. The most obvious reason for using pre-heat-treated steels is cost. The cost of purchasing and heat-treating H13 steels is usually three times that of pre-heat-treated steels.

Use Inserts for Economy

Die cavity inserts may be used to great advantage. They are most commonly used where expensive steels are required for cavities in the cases where less expensive steels are suitable for the die block. Several inserts in the cavity area will allow many machining operations to be done simultaneously. This may help to considerably shorten the required die building time and will lessen the difficulty and expense of replacement. Inserts will help to eliminate irregular shrinkage problems and will contribute to ease in machining when they are used around deep ribs and irregular shapes.

The 1958 Buick radiator grille die pictured contained more than 50 inserts in the cover and ejector halves. Time element ruled this production problem and the die was designed to keep building time to a minimum. The high number of inserts made it possible for as many as 40 people to be working on the die at one time. The die blocks were being machined on heavy equipment while the inserts were being cut, machined, and finished all over the shop. Considerable production problems were eliminated from the trimming operations by inserting the ejector half. Since the ribs varied in depth at several places along each rib, a constant draft angle would have produced variations in the width of each rib at various spots. The inserts made possible a simple machining and finishing operation to produce a

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varying draft angle which maintained constant rib width. Thus, very complicated cutting edges were eliminated from trim tools which subsequently resulted in a savings in trim tool cost and production. Engineering changes may usually be incorporated in such a die with very little difficulty, further aiding the die break-in process.

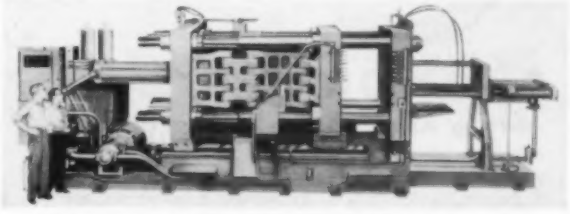
Remember the Gates and Runners

Because the cavity of a die produces the actual part and because its quality of workmanship is reflected in each part cast, we tend to concentrate our efforts only on this area of the die. The gates and runners, being trimmed off after casting, do not actually reflect visible quality of workmanship in the finished product. The writer is of the opinion that most of us over-look the need for quality workmanship in gates and runners. In many cases the decision as to where gates and runners will be placed is left to the last minute and by this time we are anxious to cast parts. With the cavity work being completed and only gates, runners and final fitting still unfinished, the diemaker is pushed to completion.

The flow of liquid metal is through the gates and runners to the cavity. The metal is cast in them the same as in the cavity. The size, length, and placement of them have great control over the appearance and soundness of the finished casting. Faulty workmanship here may cause undesirable casting conditions or even die failure. This applies not only in the building of dies but in die maintenance and repair. However, the so-called "quickie job" is more often applied to gates and runners than any other part of the die. Careful layout of the gates and runners may avoid problems otherwise diagnosed to be cavity or machine trouble ■ ■ ■

– NEWS of the INDUSTRY –

THE CLEVELAND AUTOMATIC MACHINE COMPANY has added a new, mammoth 1000-ton Hydraulic Die Casting machine to its line. It is yet another outstanding Cleveland achievement for the rapid production of large aluminum die castings weighing up to 25 lbs., being capable of fast, smooth performance under continuous, around-the-clock operation. Engineering highlights include a heavy, fabricated one-piece base; automatic lubrication; manifold hydraulics; leak-proof piping, 40 hp. motor; two, large capacity hydraulic pumps; 230 gal. hydraulic reservoir; filter capacity four times pump capacity; automatic timing remote control panel.



A. MILNE & CO., INC. has established its own warehouse for the distribution of its lines of solid and hollow tool and die steels in the Los Angeles area. Complete stocks will be carried in warehouse facilities located at 4819 E. Patata St., Bell, California. For the past several years MILNE tool steels have been distributed in the Los Angeles area by Taywood Steel Products, Inc.

A new and larger warehouse, fully stocked with Milne tool steels has been established by the company at 2230 East River Road, Dayton 39, Ohio.

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The Duplex AJAXOMATIC melts aluminum pig and gates right at the die casting machine. By pushing a button the operator initiates the complete casting cycle: the die closes and the Duplex AJAXOMATIC pours the exact required amount of molten metal directly into the cold chamber. The operator just removes the finished casting at the end of the cycle.

Automation, however, is only part of the AJAXOMATIC story. The Duplex AJAXOMATIC also gives assurance of consistent quality. The quality of a finished casting begins with the proper melting of the metal. 60 cycle induction with its two basic features of internal heating and electromagnetic stirring is used exclusively in the Duplex AJAXOMATIC. Here are the unique characteristics of the Duplex AJAXOMATIC:

- Precision temperature control —at low temperature
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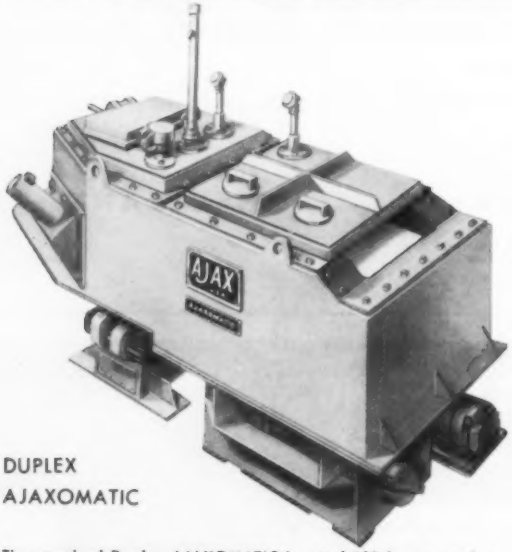

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(Concluded from Page 11)

Non-metallurgical aspects involved in the proper use of die casting dies are principally mechanical set-up, adequate preheating, proper cooling and die lubrication. Before use, dies should be set up to provide true and even contact without excessive pressures. Care should be taken to remove any flash from the contact faces since this can cause extremely high local stresses which might cause breakage. Preheating before use should provide for well warmed tools. This reduces the shock associated with the first input of hot metal and undoubtedly prevents some die cracking. Drastic cooling of the air hardening die steels or the tungsten hot work steels between shots, can likewise set up stresses which will reflect themselves in cracks or broken dies. Proper die lubrication is important in that it aids in safe cooling and prevents sticking.

Many different considerations are involved in the selection of a proper steel for die casting dies. Earlier we touched briefly on the effects of various alloying elements on different properties which affect the life of a die. Figure 3 lists general recommendations for dies for the common metals cast along with heat treating instructions. Beyond these general recommendations other factors might involve the number of parts to be cast, the complexity of the casting and the die casters' ability to accomplish heat treatment. Short runs are frequently taken care of with low alloyed steels or in some instances the higher alloyed types are used in the annealed condition. With complex parts where it may be necessary to heat the metal being cast somewhat hotter than normal, it may be advisable to move to a higher alloyed steel for best die life. Prehardened steels are coming into the picture and while generally the hardness of these materials is not as high as recommended in Figure 3, if heat treating is a problem it may be advisable to consider these types; generally, however, the life of the die is reduced somewhat because of the lower hardness necessary to allow machining of these prehardened steels.

Figure 4 lists recommendations for hot work steels for cores and ejector pins. In addition to the steels listed therein molybdenum metal has proved very successful on many core applications.

Figure 5 is a list of cold work steels recommended for trim dies. They are listed in increasing alloy content. W1 and O1 should be used where only short runs are required but where a great number of parts are involved the M3 type with extremely high resistance to abrasion would probably be most economical.

The search for new die materials is not limited to steels. Trade and technical journals have reported on the successful use of molybdenum and molybdenum alloys for piercing points on seamless tubing, for glass molds, and for other applications requiring resistance to heat. The die casting industry has experimented extensively with the use of molybdenum for cores and it has been adopted for many applications. Molybdenum has good resistance to heat checking and a low coefficient of expansion, both properties that should be beneficial in die casting die applications. There are many alloying possibilities and some of these might well solve some of today's problems with die casting dies as the metallurgy and manufacturing of molybdenum alloys advances.

■ ■ ■

PEOPLE IN DIE CASTING

EARLE W. REARWIN has joined the Reed-Prentice Division of Package Machinery Company, Worcester, Massachusetts as Die Casting Engineer. Mr. Rearwin brings to Reed-Prentice over 20 years of broad, practical experience in die casting. For the past 12 years, he has been with Precision Castings Company, Fayetteville, N.Y., most recently in charge of Research and Development.

VALOR TOOL AND MACHINE COMPANY is pleased to announce the appointment of **Ollie Clayton** to the position of General Manager for the whole company. Mr. Clayton brings to Valor m..ny years of experience in building die casting dies according to sound techniques and in the problems of die casting production. Valor Tool has now completed the rounding out of its management team and is better prepared to offer consulting services in conjunction with its sales. The balance of the team consists of **Jerry Alderman**, Sales Manager; **Robert Himmel**, Shop Superintendent; and **Leonard Blumenrich**, Comptroller.

Mr. Clayton has been very active in the SDCE during most of its existence and now holds the office of Secretary-Treasurer in the Detroit Chapter. He attended Virginia Polytechnical Institute.

THE DIRECTORS OF BOHN ALUMINUM AND BRASS CORPORATION elected **Guy H. Pitts** as Vice President of Manufacturing on January 28. Guy Pitts was born in Painted Post, New York and received his early schooling there. He received his engineering degree from the University of Michigan in 1940. He joined Bohn in 1950 and has served in the capacities of Chief Engineer, Plant Manager, and Manager of the Fabrication Division.

Bohn Aluminum and Brass also announces the appointment of **Paul Disser** to the position of Refrigeration Division Sales Manager. Mr. Disser, a graduate of the Indiana School of Business, joined Bohn in 1949 as a Sales Representative and in 1954 was advanced to Indianapolis as District Sales Manager.

Bohn operates 10 plants in Michigan, Indiana, and Illinois, and has recently acquired a new subsidiary, Plastray Corp.

ALL-STATE WELDING ALLOYS CO., INC., of White Plains, N.Y. announces the appointment of **John F. Donnelly** as Director of Technical Sales Training. Before joining All-State last October, Mr. Donnelly was process representative of Air Reduction Sales Co., and supervisor of welding instruction and production, Eastern Aircraft Division of General Motors. He holds seven Army and Navy welding certifications and is a member of the American Welding Society.

KENYON COLLEGE, Gambier, Ohio, appointed **William H. Thomas, Jr.**, from Cleveland's Pressure Castings, Inc., to the position of Vice President for Development at Kenyon. Mr. Thomas, 43, is a graduate of the College, class of 1936.

THE LAKE ERIE MACHINERY CORPORATION announces the appointment of **Archie J. Smith** as the company's new West Coast representative. Mr. Smith has over eighteen years experience in the metalworking and machine tool industry.

LLOYD W. EASTER of the Delaware Machinery and Tool Co., Inc., Muncie, Indiana, passed away on December 3, 1957. He was a member of the Indiana Chapter of the SDCE.

A. MILNE AND COMPANY, INC., nationwide distributors of solid and hollow tool and die steels, announces the appointment of **Mr. Harry C. Cooper** as Manager of the Milne Tool Steel Warehouse and Branch office in St. Louis, Missouri.

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E. F. Houghton Announces Expansion

COMPLETION OF NEW PLANT AND LABORATORY facilities which will greatly expand its manufacturing potential for the Detroit market, speed up local deliveries and reduce delivered prices is announced by E. F. Houghton & Co. Construction of the new addition, which more than doubles the plant size, was finished in January by The Sackett Company, Inc., Detroit engineers and contractors. New machinery and materials handling equipment have been installed under the direction of Dr. James T. Eaton, Houghton Vice-President—Production, Herbert Michael, Plant Engineer, and George P. Wilson, Detroit Plant Superintendent.

The new plant will supply additive-treated lubricants, cutting fluids of both petroleum and synthetic origins, drawing compounds, fire-resistant hydraulic fluids, rust preventatives, heat treating salts, carburizers, hot forging agents and quenching oils. Modern mixing, blending and oil treatment equipment have been installed, and a fully equipped laboratory completed to exercise exacting control over all processing. New facilities include horizontal and vertical compounding and mixing, stainless steel tanks for chemical processing, and modern control and testing facilities.

Houghton's Detroit Sales Division is headed by Sales Manager Harry E. Martin, with downtown offices in the Stephenson Building.

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3—**Cleveland** 400 tons, Aluminum, 1950. Ea. $12,000.00

1—**Cleveland G&N**, 400 tons, Aluminum, 1946. $5,500.00

2—**Lester HHP-3X**, 600 tons, Alum., just rebuilt. One with extra Zinc attachment if desired. Ea. $12,000.00

1—**Cleveland #50**, 50 tons Zinc. Little used, 1952. $4,500.00

1—**Kux BH-12**, Zinc, 80 tons, 1952. $5,500.00

1—**Kux HP-35**, 500 tons, Alum. Little used, like new. 3 new shot sleeves. $14,000.00

1—**Standard** 1000 tons, Zinc. Will convert to Alum. at extra cost. Practically unused. Dies open 14". $18,000.00

1—**Reed-Prentice #2**, 400 tons Alum. 1950. $13,000.00

2—**Lake Erie**, 1953, one Zinc, one Alum. Like new. Ea. $22,000.00 600 Tons.

1—**Kux BH-30**, 400 tons Zinc. $12,800.00

6—**Lester HP-1**, 3 Alum., 3 Zinc, 1951-1955. From $8,000.00-$13,000.00. Many extras, very complete. Fine working order.

2—**ABC** Zinc Casters, ea. $1,500.00

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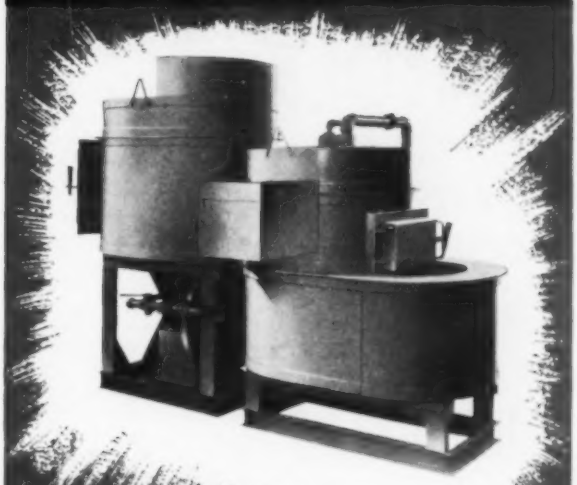

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They are easy to charge and readily adaptable to automatic charging. Handling from 450 to 1600 lbs. per hour break down capacity with holding capacity from 600 to 2400 lbs., they will melt metal faster and more economically, and at the same time produce only the highest quality metal.

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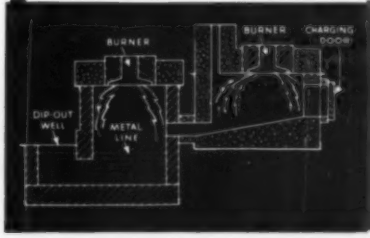

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This section is open to everyone associated with the arts and sciences of Die Casting. The editorial staff reserves the right to reject any advertising not related to Die Casting and its allied arts.

As a service to the Die Casting Industry, we offer space at a minimum of $10.00 for the first column inch and $10.00 for each additional column inch or any part thereof, payable in advance.

To answer box number advertisements, address responses to the box at Die Casting Engineer, 19370 James Couzens Highway, Detroit 35, Mich.

Closing Date: 15th of Month preceding publication.

THREE MAN SALES AGENCY with experience in Die Casting, seeks source with or without plating for Michigan. Write Box 101.

ALUMINUM DIE CASTING SOURCE (not located in Detroit area) up to 8 ounces. Reply to Box 102.

REPUTABLE MIDWEST MANUFACTURER, established 1921, wants Sales Representative now calling on the Die Casting Industry. Have an expendable product which is widely accepted. Territories now open: N. J. and Eastern Penn., New England States and Calif. Write Box 103.

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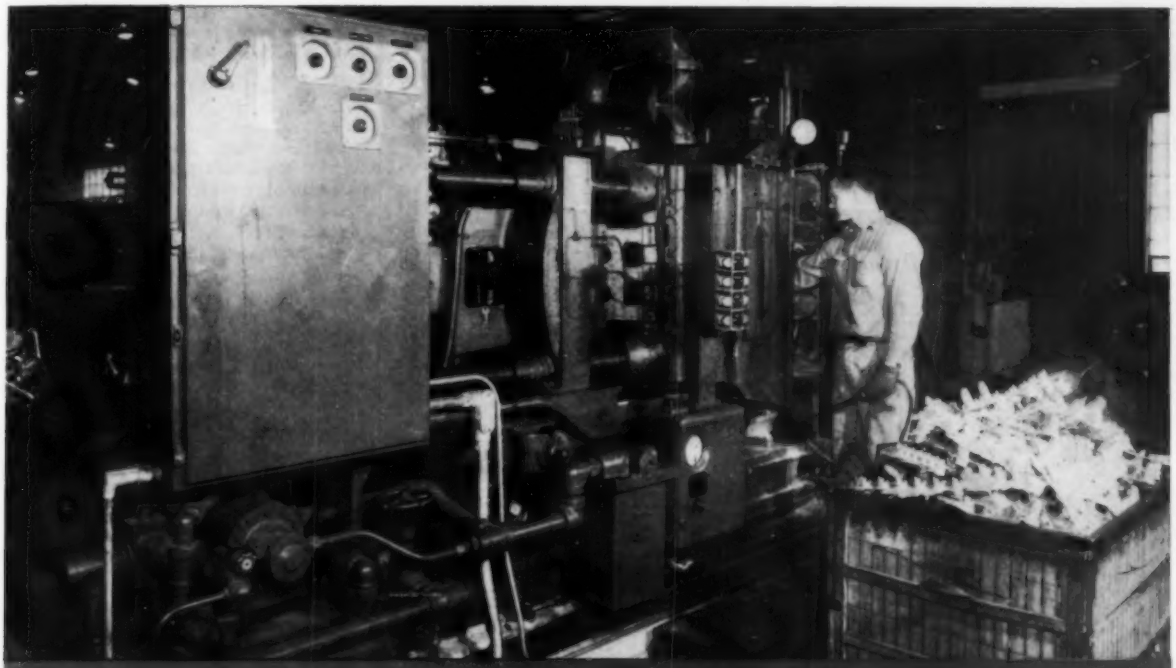

Yoder Die Casting Company reports: "REJECTS AND FINISHING COSTS REDUCED ON REED VACUCAST PARTS"

After thoroughly testing their new Reed-Prentice zinc Vacucast machine on production runs, Yoder Die Casting Company of Dayton, Ohio, reported:

- Vacuum die casting with this new REED equipment shows a marked improvement in heavy-section pressure-type zinc castings. Surface condition of the castings is considerably better.
- Finishing costs have been reduced on hardware parts to be plated.

These results are typical of users' reports. Zinc die casters using Vacucast equipment — a REED exclusive — have found:

- An as-cast surface requiring little or no polishing.
- Porosity reduced to acceptable limits.
- New die cast applications by designing with thinner walls and the addition of more assembly aids, such as screw hole bosses, etc.
- No loss of speed because of vacuum; in fact, many cases of faster cycles.

Aluminum Die Casting, Too. Contact your Reed-Prentice Sales Engineer for complete details on the zinc Vacucast. He also has preliminary data and specifications on a new aluminum unit — the Vacufeed. Reed-Prentice Vacufeed machines, featuring fully automatic feeding, are now being run experimentally on a production basis.

Yoder is running this 6-cavity shot of pressure-tight zinc castings on its 400-ton REED Vacucast machine. Because less pressure is needed, many users have found that a 400-ton Vacucast unit can cast up to 50% more projected area.

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These rings were especially designed for hot chamber die casting machines. They will give LONG LIFE which reduces cost of maintenance. They are made of high grade wear resisting iron in sizes from 1½" to 4". We make prompt delivery in small quantities.

Phone Our Representative Nearest You

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Detroit Rep. — Clifford - Rockwell Co. Phone DI 1-8873

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This 11-slide die is used to die cast an aluminum stator convertor for automotive transmissions. The slides are actuated by a specially-designed internal mechanism in the ejector half of the die. Another example of a tough die problem . . . solved by PMD engineers.

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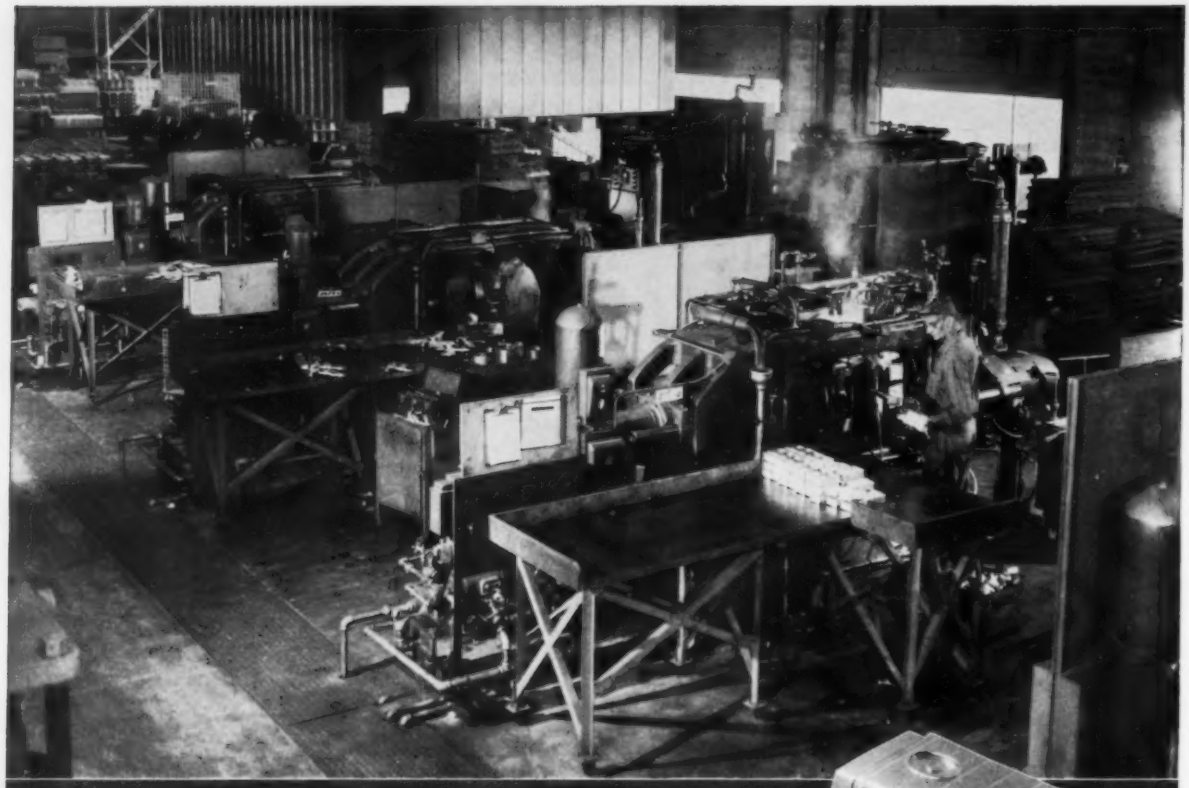

Now Bell and Howell... die casting on LESTERS...saves over 25% on this typical casting!

Bell and Howell Company, the only major photographic equipment manufacturer doing a major part of their own die casting, tell a story that is classic as a testimonial to the wisdom of installing Lester machines.

Mr. W. D. Johnson, Die Casting Manager of the company, has been working on the project since its inception, and was there when the first machines were installed—well over two years ago.

Speaking from this vantage point about the housing for their Monterey 8mm movie camera shown here, he says, "We had never done any die casting previous to our set-up of these machines a little over two years ago, and began production on this rather difficult casting on a high monthly requirement...This production schedule has continued since that time. *The savings to Bell and Howell on this particular casting have been well above the average savings of approximately 25% for the entire die casting operation."*

●

Complete details on the full line of Lester Die Casting Machines are available in Bulletin 101. *Write for your copy TODAY.*

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1" x 8"	2" x 6"	3" x 8"	4" x 8"	5" x 9"	6" x 14"
1" x 10"	2" x 7"	3" x 10"	4" x 9"	5" x 10"	6" x 16"
	2" x 8"	3" x 12"	4" x 10"	5" x 12"	6" x 18"
1¼" x 2"	2" x 10"	3" x 14"	4" x 12"	5" x 14"	6" x 20"
1¼" x 4"	2" x 12"	3" x 16"	4" x 14"	5" x 16"	6" x 25"
1¼" x 6"	2" x 16"	3" x 18"	4" x 16"	5" x 18"	
1¼" x 8"			4" x 18"	5" x 20"	7" x 8"
1¼" x 10"	2½" x 3"	3½" x 4"	4" x 20"	5" x 25"	7" x 10"
1¼" x 12"	2½" x 4"	3½" x 6"			7" x 12"
	2½" x 5"	3½" x 8"	4½" x 6"	5½" x 8"	7" x 14"
1½" x 2"	2½" x 6"	3½" x 10"	4½" x 8"	5½" x 10"	7" x 16"
1½" x 4"	2½" x 7"	3½" x 12"	4½" x 10"	5½" x 12"	7" x 18"
1½" x 6"	2½" x 8"	3½" x 14"	4½" x 12"	5½" x 14"	7" x 20"
1½" x 8"	2½" x 10"	3½" x 16"	4½" x 14"	5½" x 16"	7" x 25"
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1½" x 12"	2½" x 14"		4½" x 18"	5½" x 20"	8" x 10"
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	2½" x 18"				8" x 14"
					8" x 16"
					8" x 18"
					8" x 20"
					8" x 25"

SQUARES

1"	2"	3"	4"	8"
1½"	2½"	3¼"	6"	10"
		3½"		

ROUNDS

½"	1"	2"	3"	4"	6"
⅝"	1¼"	2¼"	3⅛"	4⅛"	6½"
¾"	1½"	2½"	3½"	4½"	7"
⅞"	1⅝"	2⅝"	3⅝"	5"	8"
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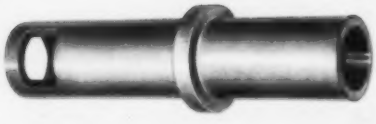

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